

CLAIMS

1. A system for improving the efficiency of a wireless communications
2 network employing a plurality of frequencies per cell comprising:

first means for monitoring a network load associated with each of said
4 plurality of frequencies and providing corresponding status values in response thereto;

second means for comparing said status values to a predetermined criterion
6 and providing an indication in response thereto when one or more of said status values
meet said criterion; and

8 third means for redistributing said network load in accordance with said
indication.

2. The system of Claim 1 wherein said criterion includes one or more
2 predetermined thresholds so that when one or more of said predetermined thresholds
is surpassed by said one or more of said status values, said criterion is met.

3. The system of Claim 2 wherein said status values are representative of
2 loading conditions for communications system resources associated with each of said
frequencies, said loading conditions representative of currently available resources
4 allocated for each of said plurality of frequencies.

4. The system of Claim 3 wherein each of said status values include a
2 hardware resource component, an air link resource component, and a handling
resource component, each component indicative of respective remaining resources.

5. The system of Claim 4 wherein said hardware resource component
2 incorporates the number of currently available channel elements for an associated
frequency.

6. The system of Claim 5 wherein said air link resource component
2 incorporates transmit power available for a particular frequency before maximum air
link capacity is reached.

7. The system of Claim 6 wherein said handling resource component
2 incorporates the number of available Walsh codes for a particular frequency.

8. The system of Claim 4 wherein said first means includes sector frequency
2 controllers, one for each of said plurality of frequencies in a given sector.

9. The system of Claim 8 wherein each of said sector frequency controllers is
2 in communication with a corresponding call resource manager.

10. The system of Claim 9 wherein said call resource manager is positioned
2 on a base station transceiver subsystem.

11. The system of Claim 9 wherein said second means includes software
2 running on each of said sector frequency controllers, said software for generating a
status value associated with a corresponding frequency, comparing said status value to
4 one of said predetermined thresholds, and generating a status message in response
thereto.

12. The system of Claim 11 wherein said status message specifies that said
2 corresponding frequency is available; said corresponding frequency is available for
handoff only; said corresponding frequency is available for emergency calls only; or
4 said corresponding frequency is unavailable.

13. The system of Claim 12 wherein said indication provided by said second
2 means incorporates said status message when said status message specifies that said

corresponding frequency is available for handoff only, for emergency calls only, or is
4 otherwise unavailable.

14. The system of Claim 13 wherein said third means includes a load-
2 balancing broker that receives said indication, said load-balancing broker in
communication with a pilot database and selector elements.

15. The system of Claim 14 wherein said selector elements are positioned on
2 a base station controller and are in communication with channel elements of a base
station transceiver subsystem associated with said cell and said corresponding
4 frequency.

16. The system of Claim 14 wherein said load-balancing broker includes
2 means for determining mobile stations not currently undergoing handoff, operating
within a predetermined restricted region about said base station transceiver
4 subsystem, and associated with frequencies indicated via said indication and issuing a
load shed request to said selector elements in response thereto.

17. The system of Claim 16 wherein said selector elements include means for
2 implementing handoff of a mobile station from a first frequency to a target frequency
in accordance with load balancing handoff criteria.

18. The system of Claim 17 wherein said selector elements include means for
2 providing a load shed response to said load-balancing broker in response to the receipt
of said load shed request, said load shed response indicating if said mobile stations
4 were successfully handed off to available frequencies specified in said load shed
request via said means for implementing handoff.

19. The system of Claim 18 wherein said load-balancing handoff criteria
2 specify that handoff is only allowed from said first frequency to a target frequency

4 having a higher frequency availability value than said first frequency and when said target frequency is within the same sector as said first frequency, said handoff criteria giving preference to target frequencies with higher frequency availability values.

20. The system of Claim 18 wherein said means for determining includes a
2 pilot database and said selector elements, said pilot database including a vertical neighbor record specifying overlying frequencies associated with each frequency.

21. The system of Claim 16 wherein said mobile stations operating within a
2 restricted region are associated with a round trip delays less than a configurable round trip delay threshold.

22. An efficient wireless communications system that accommodates a
2 plurality of frequencies per cell with a minimum amount of hardware comprising:

first means establishing communications between a wireless communications
4 device and a second communications device via allocation of communications system resources associated with a given frequency;

6 second means for monitoring said resources associated with said given frequency and providing a signal when said resources match a predetermined
8 criterion; and

10 third means for transferring said communications from said given frequency to a target frequency in response to said signal.

23. The system of Claim 22 wherein said second means includes a base
2 station transceiver subsystem controller having a selector frequency controller and a call resource manager, said call resource manager in communication with channel
4 elements on a base station transceiver subsystem associated with said given frequency.

24. The system of Claim 23 wherein said second means includes a target base
2 station transceiver subsystem controller having a target selector frequency controller
and a target call resource manager, said target call resource manager in
4 communication with target channel elements on a target base station transceiver
subsystem associated with said target frequency.

25. The system of Claim 24 wherein said third means includes a load-
2 balancing broker in communication with a pilot database running on a selector
element controller in communication with selector elements of a selector bank
4 subsystem of a base station controller that controls said base station transceiver
subsystem and said target base station transceiver subsystem, said base station
6 controller in communication with a landline network via a mobile switching center.

26. The system of Claim 25 wherein said mobile switching center includes a
2 call control processor, a supplementary services adjunct, and a base station manager.

27. The system of Claim 22 wherein said third means includes means for
2 handing off said wireless communications device to a target frequency to facilitate
load balancing between frequencies, said wireless communications device less likely
4 than other wireless communications devices operating communicating via said given
frequency that do not match said predetermined criterion to subsequently require
6 handoff for load balancing purpose.

28. The system of Claim 27 wherein said predetermined criterion includes a
2 round trip delay value less than a predetermined round trip delay threshold.

29. The system of Claim 22 wherein said third means includes means for
2 employing existing vertical neighbors and horizontal neighbors to said target
frequency to select said target frequency so as to minimize instances of subsequent
4 hard handoff.

30. The system of Claim 29 wherein said means for employing includes
2 generating a frequency availability value that is inversely related to the number of
horizontal and vertical neighbors of said target frequency and selecting said target
4 frequency to have a high frequency availability value.

31. A system for strategically distributing communications system resources
2 in a wireless communications system comprising:

first means for monitoring traffic in a cell of said wireless communications
4 system, said cell associated with a plurality frequencies, each frequency associated
with a predetermined geographic region within said cell that may overlap one or more
6 other geographic regions within said cell;

second means for monitoring system resources in each cell and providing a
8 resource status indication in response thereto;

third means for comparing said resource status indication to predetermined
10 criteria and providing a load reassignment command in response thereto; and

fourth means for selectively reassigning network load among said plurality of
12 frequencies in response to said load reassignment command to maintain said system
resource status indication in concurrence with said criteria.

32. A method for improving the efficiency of a wireless communications
2 network that has a cell that accommodates a plurality of frequencies comprising the
steps of:

4 monitoring network load associated with each of said plurality of frequencies
and providing corresponding status values in response thereto;

6 comparing said status values to predetermined thresholds and providing an
indication in response thereto when one or more of said status values exceeds one or
8 more of said predetermined thresholds; and

redistributing said network load in accordance with said indication.